

REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-20, 23-47, and 49 are pending. Claims 1, 23, 24, 25, 26, 29, 30, 38, 39, 47, and 49 are amended to either incorporate features of dependent claims into respective base claims, to place dependent claims in independent form, or to return previously amended claims to their original form. Claims 21, 22, 48, and 50-51 are canceled without prejudice or disclaimer. Support for the amendment to Claim 1 can be found in original Claim 1 and now-canceled Claim 21 in its original form. Independent Claims 38 and 39 are amended to incorporate the features of now-canceled dependent Claim 21. Claims 47 and 49 are placed in independent form. Support for the remaining amendments can be found in the original versions of the amended claims. No new matter is added.

As all of the features incorporated into amended Claims 1, 38, 39, 47, and 49 have already been considered by the Examiner, and the amendments to the above-noted claims are merely to place the application in better form for appeal, Applicants respectfully request that the above-noted amendments be entered.

In the outstanding Office Action, Claims 1-6, 12, 27-40, 42-45, and 51 were rejected under 35 U.S.C. §102(e) as anticipated by Luo et al. (U.S. Patent No. 6,884,464, herein "Luo"). Claims 7-11, 13-24, 41, and 46-50 were rejected under 35 U.S.C. §103(a) as obvious over Luo in view of Seutter et al. (U.S. Patent Pub. 2003/0215570, herein Seutter).

Regarding the rejection of Claims 1-6, 12, 27-40, 42-45, and 51 as anticipated by Luo, that rejection is respectfully traversed by the present response.

As Claim 51 is canceled without prejudice or disclaimer, Applicants respectfully submit that the rejection of Claim 51 is moot.

Amended independent Claim 1 recites:

A method of depositing a silicon-containing film on a substrate,
the method comprising:
 providing a substrate in a process chamber of a processing system;
 heating the substrate;
 exposing a HCD process gas to the substrate; and
 depositing a silicon-containing epitaxial film on the substrate using
the HCD process gas.

Accordingly, the method includes depositing an epitaxial film on the substrate using HCD gas. Inasmuch as amended Claim 1 incorporates the features of now-canceled dependent Claim 21, Applicants address the rejection of now-canceled dependent Claim 21 in Applicants' discussion of amended Claim 1.

Luo is devoid of any mention of depositing an epitaxial layer using an HCD gas, and the outstanding Office Action, in its rejection of now-canceled dependent Claim 21, relies on Seutter for this feature.¹ However, as discussed in the previous response, Seutter does not disclose any epitaxial films. The outstanding Office Action points to paragraph [0019] of Seutter for the feature of depositing an epitaxial layer. Applicants respectfully submit that the monolayer disclosure referenced in [0019] does not constitute an epitaxial teaching. Rather, monolayer films may be amorphous and are certainly not inherently epitaxial. One online glossary related to the art defines "epitaxial," stating:

[A] single crystal layer formed on top of a single crystal substrate. An epitaxial layer will typically have a different doping level and or type than the substrate upon which the epitaxial layer is formed. In some cases the epitaxial layer may be a completely different type of material than the substrate upon which it is grown. If the substrate and the epitaxial layer are both the same element or compound then the process is homoepitaxy and if the epitaxial layer and the substrate are different elements or compounds then the process is heteroepitaxy. see also, crystalline.²

Furthermore, the term mono-layer merely defines the layer as having a thickness of only a single molecule. Thus, the mono-layer need not itself form a crystalline structure. Indeed, a monolayer may be formed as islands of material scattered across the surface of the substrate

¹ Outstanding Office Action at 7.

² <http://www.semiconductimes.com/common/glossary.asp?termid=274> (last visited April 6, 2006).

without any crystalline formation at all. Accordingly, Applicants respectfully submit that Seutter fails to disclose, in the section cited by the outstanding Office Action or anywhere else, depositing an epitaxial layer using HCD gas as recited in amended independent Claim 1. Therefore, Applicants respectfully submit that amended Claim 1 patentably distinguishes over any reasonable combination of Luo with Seutter for at least the reasons discussed above.

Claims 2-20 and 23-37 depend, directly or indirectly, from amended independent Claim 1, and Applicants respectfully submit that Claims 2-20 and 23-37 patentably distinguish over the cited references for at least the same reasons as amended independent Claim 1.

Regarding the rejection of independent Claims 38 and 39 as anticipated by Luo, that rejection is respectfully traversed by the present response.

Each of Claims 38 and 39 is amended to incorporate the features of now-canceled dependent Claim 21, i.e., using HCD gas to deposit an epitaxial layer, just as was done with independent Claim 1. Accordingly, Applicants respectfully submit that amended independent Claims 38 and 39 patentably distinguish over the cited references for at least the same reasons as amended independent Claim 1.

Claims 40-46 depend from amended independent Claim 39, and Applicants respectfully submit that Claims 40-46 patentably distinguish over the cited references for at least the same reasons as amended independent Claim 39.

Applicants wish to make the following additional remarks regarding the rejection of dependent Claim 16 as obvious over Luo in view of Seutter. Dependent Claim 16 recites:

The method according to claim 1, wherein the exposing further comprises exposing a germanium-containing gas to the substrate.

The outstanding Office Action relies on Seutter for the feature of exposing the substrate to a germanium-containing gas.³ However, Seutter disfavors exposing the substrate to germanium, and in fact describes germanium as an **impurity**.⁴ The outstanding Office Action points to paragraph [0023] of Seutter for the feature of exposing a germanium-containing gas to the substrate.⁵ However, paragraph [0023] states:

Preferably, the silicon precursor used is hexachlorodisilane having a low content of impurities. It has been observed that hexachlorodisilane having a high content of aluminum, copper, and/or **germanium impurities** may adversely affect the quality of the deposited silicon nitride film. Preferably, hexachlorodisilane has a low content of aluminum impurities of about 3,700 ppb (parts per billion) or less, more preferably about 3.0 ppb or less, copper impurities of about 6,800 ppb or less, preferably about 10 ppb or less, **germanium impurities** of about 1,200 ppb or less, preferably about 17 ppb or less, and titanium impurities of about 10 ppb or less.⁶

Accordingly, paragraph [0023] merely describes **undesired** germanium impurities.

Applicants respectfully submit that a person of ordinary skill in the art would not look to combine the invention of Luo with the invention of Seutter such that a method of depositing a silicon-containing film by exposing a germanium-containing gas to a substrate as recited in amended Claim 1 would be the result. Rather, Seutter teaches away from such a combination.

MPEP § 2141.02VI states:

[a] prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention.” *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

The quote from Seutter above clearly discourages exposing the substrate to germanium.

Accordingly, Applicants respectfully submit that no reasonable combination of Luo with

³ Outstanding Office Action at 7.

⁴ Response submitted September 1, 2005 citing Seutter at paragraph [0023].

⁵ Outstanding Office Action at 8.

⁶ Seutter at [0023] (emphasis added).

Seutter renders dependent Claim 16 obvious, and the rejection of dependent Claim 16 is overcome.

Regarding dependent Claim 18, Claim 18 recites exposing at least one of GeH₄ and GeCl₄ to the substrate. Applicants respectfully submit that both Luo and Seutter fail to disclose GeH₄ and GeCl₄. For the specific chemical formulas noted above, the outstanding Office Action again points to paragraph [0023] of Seutter. However, as is clear from the quotation of paragraph [0023] above, and as discussed in the previous response, Seutter does not mention GeH₄ or GeCl₄. Indeed, Seutter teaches away from exposing any germanium-containing gas to the substrate, much less the specific combinations of germanium and other elements recited in independent Claim 18.

MPEP §2143 states the standard for obviousness as follows:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. **Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.**

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).⁷

As neither Luo nor Seutter, alone or in any reasonable combination, recite all of the features of amended independent Claim 18, Applicants respectfully submit that the outstanding Office Action has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully submit that the rejection of Claim 18 is overcome.

Regarding amended dependent Claim 26, amended Claim 26 recites the feature of depositing a SiGe film having **a germanium content greater than about two atomic percent.**

⁷ MPEP §2143 citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (emphasis added).

In contrast, neither of the cited references discloses a SiGe film. As discussed above, Luo is devoid of any mention of germanium at all. Seutter describes germanium as an unwanted impurity and teaches that the amount of germanium inadvertently allowed into the process gas should be kept below about 1,200 parts per billion and preferably below about 17 parts per billion.⁸ Thus, no reasonable combination of Seutter and Luo would include an SiGe film having a germanium content greater than about two atomic percent as recited in amended dependent Claim 26. Accordingly, Applicants respectfully submit that the rejection of Claim 26 is overcome for at least the reasons discussed above.

Regarding the rejection of Claims 47-50 as obvious over Luo in view of Seutter, that rejection is respectfully traversed by the present response. As Claims 48 and 50 are canceled, Applicants respectfully submit that the rejection of Claims 48 and 50 is moot.

Claims 47 and 49 recite the feature of using HCD gas to deposit an epitaxial silicon-containing film. As discussed above regarding the rejection of independent Claim 1 and in the previous response, none of the cited references discloses depositing an epitaxial layer on a substrate using HCD gas. Accordingly, Applicants respectfully submit that each of Claims 47 and 49 patentably distinguish over the cited references for at least the same reasons as amended independent Claim 1.

This amendment is submitted in accordance with 37 C.F.R. §1.116, which permits the entering of amendments complying with any requirement of form expressly set forth in a previous Office Action or presenting rejected claims in better form for consideration on appeal. As this amendment does not raise new issues requiring further consideration and/or search, Applicants respectfully request that the present amendment be entered under 37 C.F.R. §1.116.

⁸ Seutter at 2, [0023].

Should Examiner Harrison continue to disagree with the above-discussed distinctions, Applicants respectfully request that Examiner Harrison provide an explanation via Advisory Action pursuant to MPEP §714.13 specifically rebutting the points raised herein for purposes of facilitating the appeal process.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Steven P. Weihrouch
Attorney of Record
Registration No. 32,829

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)
LS/rac

Edwin D. Garlepp
Registration No. 45,330

I:\ATTY\LS\24s\243476US\243476US-AM-DUE-6-7-06.DOC